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PATENT

Attorney Docket No. 2269-3028.1US (96-767.1)

NOTICE OF EXPRESS MAILING

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Date of Deposit with USPS: May 12, 2003

Person making Deposit: Chris Haughton

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Serial No.: 09/358,940 Group Art Unit No.: 1765

Filing date: July 22, 1999 Examiner: V. Perez-Ramos

For (title): HIGH SELECTIVITY BPSG TO TEOS ETCHANT

TRANSMITTAL OF BRIEF ON APPEAL (PATENT APPLICATION — 37 C.F.R. § 192)

Commissioner of Patents
Washington, D.C. 20231

Sir:

1. Transmitted herewith in triplicate is the APPEAL BRIEF in this application with respect to the Notice of Appeal filed on March 14, 2003

2. STATUS OF APPLICATION
This application is on behalf of
- ☒ other than a small entity
- ☐ small entity

3. FEE FOR FILING APPEAL BRIEF
Pursuant to 37 C.F.R. § 1.17(f) the fee for filing the Appeal Brief is:

- ☐ small entity status $160
- ☒ other than a small entity $320

4. EXTENSION OF TIME

- ☐ A petition for Extension of Time for a month extension of time for filing the Appeal Brief is enclosed.

5. FEE PAYMENT

- ☒ Check No. 4278 is enclosed in payment of the fee for filing the Breif on Appeal.
- ☐ Please charge this fee to deposit account No. 20-1469 (a duplicate copy of this notice is enclosed--see below).

Any additional appeal fees which are not otherwise submitted herewith or which are insufficient should be charged to deposit account no. 20-1469. A duplicate copy of this notice is enclosed. Please address all communications in connection with this appeal to the address indicated below.

Respectfully submitted,

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Date: May 12, 2003
Enclosures: As identified above

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5/19/03

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of:

Lee et al.

Serial No.: 09/358,940

Filed: July 22, 1999

For: HIGH SELECTIVITY BPSG TO TEOS ETCHANT

Confirmation No.: 2152

Examiner: V. Perez-Ramos

Group Art Unit: 1765

Attorney Docket No.: 2269-3028.1US
(96-767.01/US)

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APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P. O. Box 1450
Alexandria, Virginia 22313-1450

Attention: Board of Patent Appeals and Interferences

Sirs:

This brief is submitted in triplicate and in the format of 37 C.F.R. § 1.192(c). A check in the amount of $320.00 for the fee under 37 C.F.R § 1.17(c) for filing a brief in support of an appeal is enclosed.

REAL PARTY IN INTEREST

The real party in interest is Micron Technology, Inc., a corporation of the State of Delaware, having a place of business at 8000 South Federal Way, Boise, Idaho 83707-0006, the assignee of the entire right, title and interest for the present application in the United States and all foreign countries.

RELATED APPEALS AND INTERFERENCES

There are no appeals or interferences known to appellant related to the pending appeal that will directly affect, be directly affected by, or otherwise have a bearing on the decision in the pending appeal of the Board of Appeals and Interferences.

STATUS OF CLAIMS

Claims 1 through 4 and 6 through 15 are currently pending in the application and stand rejected.

No claims are allowed.

The rejection of claims 1 through 4 and 6 through 15 is being appealed.

STATUS OF AMENDMENTS

All amendments to the claims have been entered.

SUMMARY OF THE INVENTION

The present invention relates to an organic acid/fluoride-containing solution etchant formulation having high selectivity for BPSG to TEOS and methods for its use in the production of semiconductor devices. Hydrofluoric acid is a known etchant for etching BPSG and TEOS. However, it has been found that the addition of an organic acid (such as acetic acid, formic acid, and oxalic acid) to a fluoride-containing solution (such as hydrofluoric acid and ammonium fluoride (preferably 40% NH_4F in water)) dramatically increases selectivity of BPSG to TEOS.

Etchants were formulated from glacial acetic acid (99.7% by weight in water) and hydrofluoric acid (49% by weight in water). The results (etch rate, selectivity and uniformity) of various etchant formulations are presented in Table 1, as follows:

TABLE 1

Etchant (vol. ratio glacial acetic acid to 49% HF)	Etching rate through TEOS (Å/min)	Etching rate through BPSG (Å/min)	BPSG Standard Deviation (%)	Selective ratio (BPSG/TEOS)
200:1	2.2	59	0	27
100:1	4.6	193	2.4	42
50:1	11.6	638	13.7	55

As can be clearly seen from Table 1, reproduced from page 4 of Appellants' specification, the selectivity and uniformity increased with increasing hydrofluoric acid concentration. The preferred etchant to obtain high selectivity and good uniformity is 100:1 volume ratio of 99.7% glacial acetic acid to 49% hydrofluoric acid. However, it is believed that etchant ratios ranging from 1:1 to 500:1 will achieve adequate selectivity.

FIGs. 1-5 of the drawings illustrate a technique for utilizing an etchant of the present invention in the formation of an opening in a BPSG layer. FIG. 1 illustrates an intermediate structure 100 comprising a substrate 102 having a first side 104 with a first barrier layer 106 of TEOS applied thereover. A second barrier layer 108 of BPSG is deposited over the first TEOS barrier layer 106.

A nitride layer 110 is patterned over the second barrier layer 108 of BPSG and has at least one opening 112, as shown in FIG. 2. The second barrier layer 108 of BPSG is etched with an etchant of the present invention to form a partial opening 114. Since the etchant of the present invention is selective to BPSG, the etch effectively ceases at the first barrier layer 106 of TEOS, as shown in FIG. 3. The first barrier layer 106 of TEOS is then etched with a less aggressive etchant, such as a TMAH / hydrofluoric acid mixture or a 35-40% by weight ammonium fluoride/ 4-6% by weight phosphoric acid solution in water, which is less damaging to the

substrate 102, to form a full opening 120, as shown in FIG. 4. The nitride layer 110 is stripped, as shown in FIG. 5.

The etchant of the present invention can be utilized in any etching situation where selectivity of BPSG to TEOS barrier layers is desired, such as contact openings, container etching, and the like. Furthermore, the etchant of the present invention can be utilized in processes, such as a double side container process, wherein no masking step is required.

ISSUES

Whether claims 1 through 4 and 6 through 15 are unpatentable over Grant et al.(U.S. Patent No. 5,439,553) in view of Gigante (U.S. Patent No. 4,372,803) and further in view of Lin (U.S. Patent No. 6,251,742).

GROUPING OF THE CLAIMS

Appellants propose to group the claims on appeal into two (2) groups, as independent claims 1 and 9 stand and fall separately from one another.

Group 1. Claims 1 through 4 and 6 through 8. For purposes of this appeal, claims 2 through 4, 6 and 7 stand and fall with claim 1. Claim 8 stands, but does not fall with claim 1.

Group 2. Claims 9 through 15. For purposes of this appeal, claims 10 through 12 and 15 stand and fall with claim 9. Claims 13 and 14 stand, but do not fall with claim 9.

ARGUMENT

Authorities Relied Upon

Appellants submit that three criteria must be met for a *prima facie* case of obviousness to be present under 35 U.S.C. § 103. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings. Second, there must be a reasonable expectation of success. Third, the prior art reference or combination of the references must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed

combination and the reasonable expectation of success must both be found in the prior art, and not based on appellants' disclosure. MPEP §2143.

The "obvious to try" standard is inappropriate under §103:

> In some cases, what would have been 'obvious to try' would have been to vary all parameters or try each of numerous possible choices until one possibly arrived at a successful result, where the prior art gave either no indication of which parameters were critical or no direction as to which of many possible choices is likely to be successful. . . . In other words, what was 'obvious to try' was to explore a new technology or general approach that seemed to be a promising field of experimentation, where the prior art gave only general guidance as to the particular form of the claimed invention or how to achieve it.

MPEP § 2145 (citations omitted).

M.P.E.P. § 2144.05 states that a "prima facie case of obviousness may ... be rebutted by showing that the art . . . teaches away from the claimed invention."

35 U.S.C. §103

Claims 1 through 4 and 6 through 15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Grant et al.(U.S. Patent No. 5,439,553) in view of Gigante (U.S. Patent No. 4,372,803) and further in view of Lin (U.S. Patent No. 6,251,742).

Appellants submit that the proposed combination of references fail to establish a *prima facie* case of obviousness. Three criteria must be met for a *prima facie* case of obviousness to be present under 35 U.S.C. § 103. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings. Second, there must be a reasonable expectation of success. Third, the prior art reference or combination of the references must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on appellants' disclosure. MPEP §2143.

Cited References

Grant discloses a dry (gaseous/vapor) etch wherein oxides are etched with a halide-containing species and a low molecular weight organic molecule having a high vapor pressure.

Gigante discloses a method for etch thinning silicon devices in charged coupled imagers. The disclosed devices do not include BPSG and TEOS, but instead include p+ doped substrates. The method includes three sequential etches including a first etchant of 2 parts KOH to 2 parts H_2O at 60°, a second etchant of 1 part HF to 3 parts HNO_3 to 10 parts acetic acid and a critical amount of H_2O_2 and water, and a third etch of 1 gm potassium permanganate to 150 ml HF and 150 ml acetic acid. (Gigante, col. 4, lines 1-38.)

Lin discloses a method of manufacturing a cup-shaped capacitor. A P-type substrate 2 is provided with a thick field oxide region 4. A silicon dioxide layer 6 is formed as a gate oxide on the substrate 2. A first polysilicon layer 8 is formed over the silicon dioxide layer 6 and field oxide regions 4. Dielectric layers 20, 22 are formed thereover. An etch stop layer 24 is formed over the dielectric layers 20, 22 and another dielectric layer 26 is formed on the etch stop layer 24. A two-step etching process creates slots 30 in the dielectric layer 26 and stops at the etch stop layer 24. (Lin, FIG. 2.)

Argument for Patentability of Claimed Invention

Appellants submit that claims 1 through 4 and 6 through 15 are clearly allowable over the proposed combination of references under 35 U.S.C. § 103. Appellants submit that the proposed combination of references fail to teach or suggest every limitation of the presently claimed invention. By way of contrast with Grant, Gigante and Lin, independent claim 1 of the presently claimed invention recites an etchant solution which selectively etches borophosphosilicate glass over tetraethyl orthosilicate, said etchant solution comprising an organic acid and a fluoride containing solution provided in a selected volumetric ratio relative to one another, wherein the selected volumetric ratio of the organic acid to the fluoride-containing solution is about 10:1 to about 500:1.

The proposed combination of references fails to teach or suggest every element of the presently claimed invention. Specifically, the proposed combination of references fails to teach or suggest "an etchant solution which selectively etches borophosphosilicate glass over tetraethyl orthosilicate" as recited in claim 1 of the presently claimed invention. The Examiner acknowledges that Lin and Gigante lack any disclosure about etching BPSG selectively with regard to TEOS and instead relies upon Grant as disclosing the etching of BPSG over TEOS. (Paper No. 21, page 4.)

However, Grant does not disclose a **selective etchant solution,** but rather a **vapor phase treatment method.** (Grant, Abstract.) The Examiner acknowledges that Grant lacks this teaching and cites Lin as disclosing the equivalence of etching solutions and vapor-phase etchants. (Paper No. 21, page 2.) However, the equivalence of a liquid and vapor etch for selectively etching BPSG over TEOS has not been established.

Lin merely discloses the acceptability of an etchant of a HF solution, HF vapor or BOE *within the Lin invention* previously discussed. Lin also discloses the use of such etchants with an etch stop layer 24 which is contrary to the present invention as it suggests that the etchant lacks selectivity. (Lin, col. 3, lines 49-64.) Accordingly, appellants submit that Lin lacks any disclosure that this solution preferably etches BPSG to TEOS. Thus, Lin, alone or in combination with Grant, fails to teach or suggest the "equivalence between HF solutions and vapor-phase etchants for layer etching" within the presently claimed invention as it fails to disclose anything regarding preferential etching. (Paper No. 21, page 2.)

Furthermore, the specification of the present invention states that there are disadvantages associated with a vapor, as opposed to a liquid, etchant. (Specification, page 3.) Similarly, Grant proposes a vapor phase etch to overcome the shortcomings of liquid etches. (Grant, col. 1, lines 10-20.) Both references clearly dispute a finding of the equivalence of liquid and vapor phase etching. The Examiner also cites three other references (U.S. Patent 5,654,244 to Sakai, U.S. Patent 6,335,279 to Jung and U.S. Patent 6,077,742 to Chen) as disclosing the equivalence of vapor-phase and liquid-phase etchants. However, none of these references disclose the

equivalence of a liquid and vapor etch for selectively etching BPSG over TEOS as recited in the presently claimed invention.

Instead, Sakai discloses a process for producing a semiconductor strain-sensitive sensor wherein first and second protective layers 4, 6 are formed over a semiconductor substrate. In order to protect the first protective layer 4 during the etch of the second protective layer 6, Sakai discloses forming a metal etch stop layer 8 between the two protective layers. (Sakai, abstract, col. 1, lines 30-36.) Thus, Sakai lacks disclosure of an etchant solution which selectively etches BPSG over TEOS according to the presently claimed invention.

Sakai also discloses forming an oxide layer 10 on a N-type layer, patterning the oxide layer 10 and removing the layer by etching. (Sakai, col. 5, lines 15-30.) However, this process lacks any disclosure of an etch selective for BPSG over TEOS. Thus, Sakai lacks disclosure of any selective etch and cannot teach the equivalence of liquid and vapor etch for the selective etch of BPSG over TEOS. Similarly, Jung lacks disclosure of a selective etchant. Chen discloses a selective etch for doped BSG over doped PSG. (Chen, col. 7, line 52-col. 8, line 34.) But, Chen lacks disclosure of an etch selective for BPSG over TEOS.

Accordingly, the proposed combination of references fail to teach of suggest an "etchant solution which selectively etches borophosphosilicate glass over tetraethyl orthosilicate" as recited in claim 1 of the presently claimed invention.

The proposed combination of references also fails to teach or suggest that the etchant solution comprises "an organic acid and a fluoride-containing solution provided in a selected volumetric ratio relative to one another, wherein the selected volumetric ratio of the organic acid to the fluoride containing solution is about 10:1 to about 500:1." The Examiner acknowledged that Grant fails to disclose the claimed volumetric ratio, but suggests the claimed ratio would be obvious. (Paper No. 21, page 2.)

Appellants respectfully submit that Examiner is improperly applying an "obvious to try" rationale in this case. (Paper No. 21, page 2; "variation of the process parameters is obvious and expected.") The "obvious to try" standard is inappropriate under §103:

> In some cases, what would have been 'obvious to try' would have been to vary all parameters or try each of numerous possible choices until one possibly arrived at a

> successful result, where the prior art gave either no indication of which parameters were critical or no direction as to which of many possible choices is likely to be successful. . . . In other words, what was 'obvious to try' was to explore a new technology or general approach that seemed to be a promising field of experimentation, where the prior art gave only general guidance as to the particular form of the claimed invention or how to achieve it.

MPEP § 2145 (citations omitted). Grant merely suggests varying the pressure, temperature and ratio of a carrier gas to HF. (Grant, col. 6, lines 18-21.) Grant lacks any teaching or suggestion of any ratio of organic acid to fluoride containing solution and also lacks any teaching or suggestion of modifying the ratio as claimed.

The Examiner states that Gigante is cited to show that the claimed volumetric ratio is known in the art. (Paper No. 24, page 2.) However, Gigante discloses a method for etch thinning silicon devices in charged coupled imagers. The method includes three sequential etches including a first etchant of 2 parts KOH to 2 parts H_2O at 60°, a second etchant of 1 part HF to 3 parts $HN0_3$ to 10 parts acetic acid and a critical amount of H_20_2 and water, and a third etch of 1 gm potassium permanganate, 150 ml HF and 150 ml acetic acid. (Gigante, col. 4, lines 1-38.) Such is not the presently claimed invention.

Even assuming Gigante discloses an etchant composition comprising an organic acid and HF in a ratio of 10:1, Gigante lacks any disclosure that such a composition would be suitable in the present invention. The etchant in Gigante is used on a disclosed device which ***does not*** include BPSG and TEOS, but instead includes a p+ doped substrate. Gigante also lacks any disclosure that this solution preferably etches BPSG to TEOS. Instead, Gigante merely discloses the use of the etchant solutions to etch-thinning silicon devices with a p+ surface.

In contrast, the presently claimed invention comprises a solution for use in a wet etching process wherein a semiconductor device, which contains BPSG *and* TEOS, can be selectively etched by an etchant solution comprising an organic acid and a fluoride-containing solution provided in a selected volumetric ratio relative to one another, wherein the selected volumetric ratio of the organic acid to the fluoride-containing solution is about 10:1 to about 500:1. An exemplary application of this invention includes a TEOS layer deposited over the semiconductor

device 6 components, followed by a BPSG layer deposited over the TEOS layer. (Specification, page 3, lines 18-20.) The TEOS layer is used to prevent boron and phosphorus in the BPSG layer from contaminating the components of the semiconductor device. (Specification, page 3, lines 15-17.) The etchant solution is used to etch desired areas in the uppermost BPSG layer. Since the etchant solution is between 27-55 times more selective for BPSG than for TEOS, the solution will etch the BPSG layer but will substantially cease etching when the TEOS layer is exposed. (Specification, page 3, lines 20-22; Page 4, Table 1.)

Appellants respectfully disagree that "it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Grant by utilizing the ratio of the organic acid to the fluoride-continuing solutions used by Applicants, as per Gigante, since Grant himself provides a motivation to do so, because the ratio is well-known in the art as evidence by Gigante's disclosure, and furthermore, because the volumetric ratio is a result-effective variable, and its variation would have been expected from and obvious to one skilled in the art with the purpose of establishing the optimum process conditions." (Paper No. 21, page 3.) As stated, Grant discloses a vapor phase process and the only teachings of such limitations appears in appellants' own disclosure, the use of which by the Examiner would constitute impermissible hindsight. This is particularly true since Grant dwells on the use of vapors and mixtures of vapors, which mixtures would be extremely difficult to control to arrive at different ratios of constituents. Additionally, Lin's disclosure of HF solution is used in combination with an etch stop layer and thus lacks any disclosure of the preferential etching of the presently claimed invention.

M.P.E.P. § 2144.05 states that a "prima facie case of obviousness may ... be rebutted by showing that the art . . . teaches away from the claimed invention." Appellants submit that Grant teaches away from the proposed modification to the vapor process. As discussed above, Grant discloses a vapor phase treatment method to etch oxides. (Grant, col. 3, lines 35-37.) The method etches oxides with a halide-containing species and a low molecular weight organic molecule having a high vapor pressure at standard conditions. Etching is performed at preset wafer temperature in an enclosed chamber at a pressure such that all species present in the

chamber, including water, are in the gas phase and condensation of species present on the etched surface is controlled. Thus all species involved remain in the gas phase even if trace water vapor appears in the process chamber. (Grant, Abstract.)

Grant teaches away from the proposed modification of replacing the vapor etch process in Grant with either the multi-solution-based wet etch process as used with Gigante, the alternative etch solution of Lin or the etchant solution of the presently claimed invention. Grant is directed toward a method of etching oxides on a substrate which minimizes or prevents deposition of contaminants on the substrate and specifically teaches that

> the etching of oxides is typically carried out using a halide-containing water solution, for instance a HF/water solution, or reactive ion etching (RIE). The former method is not compatible with integrated processing of integrated circuits while the latter damages the surface of the substrate and contaminates the near-surface region of the substrate. As a result, neither method permits integration of oxide etching with other steps performed in a cluster process.

(Grant, col. 1, lines 10-19.) Appellants respectfully submit that Grant teaches away from incorporating a wet etchant solution. Accordingly, appellants submit that no motivation exists with the references themselves to combine the references. Further, appellants submit that the proposed combination of references fail to teach or suggest every element of independent claim 1. Thus, independent claim 1 is not rendered obvious by Grant in combination with Gigante and Lin.

Claims 2 through 8 are each allowable as depending, either directly or indirectly, from allowable claim 1.

Claim 8 is further allowable as the proposed combination of references fail to teach or suggest an etchant solution exhibiting a selectivity ratio of borophosphosilicate glass to tetraethyl orthosilicate between about 27:1 and 55:1. Instead, the references lack any disclosure of a borophosphosilicate glass to tetraethyl orthosilicate selectivity ratio.

Claim 9 of the presently claimed invention avoids the cited references due to the deficiencies in the references cited and applied as are set forth above with respect to claim 1. Claim 9 recites an etchant solution which selectively etches borophosphosilicate glass over tetraethyl orthosilicate, said etchant solution comprising an organic acid and a fluoride-

containing solution, wherein the etchant solution exhibits a selectivity ratio of borophosphosilicate glass to tetraethyl orthosilicate between about 27:1 and 55:1. As stated, Grant does not disclose an etchant **solution** and Grant, Gigante and Lin lack any disclosure regarding whether the disclosed vapors or etchant solutions selectively etches borophosphosilicate glass over tetraethyl orthosilicate. Further, the disclosed references fail to teach or suggest an etchant solution exhibiting a selectivity ratio of borophosphosilicate glass to tetraethyl orthosilicate between about 27:1 and 55:1. As the proposed combination of references fails to teach or suggest every element of independent claim 9, appellants respectfully submit that claim 9 is not rendered obvious by the proposed combination of references.

Claims 10 through 15 are each allowable as depending from allowable claim 9.

Claim 13 is further allowable as the proposed combination of references fail to teach or suggest an etchant solution wherein acetic acid is in a volumetric ratio with the hydrofluoric acid at about 1:1 to about 500:1.

Claim 14 is further allowable as the proposed combination of references fail to teach or suggest an etchant solution wherein the acetic acid is in a volumetric ratio with the hydrofluoric acid at about 10:1 to about 100:1.

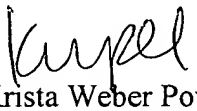
CONCLUSION

Appellants request the reversal of the rejection of currently pending claims 1 through 4 and 6 through 15 for the reasons set forth above.

APPENDIX

Appealed claims 1 through 4 and 6 through 15 are attached hereto as the Appendix.

Respectfully submitted,



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Document in ProLaw

APPENDIX

4/1997

1. An etchant solution which selectively etches borophosphosilicate glass over tetraethyl orthosilicate, said etchant solution comprising an organic acid and a fluoride-containing solution provided in a selected volumetric ratio relative to one another, wherein the selected volumetric ratio of the organic acid to the fluoride-containing solution is about 10:1 to about 500:1. organic/acetic/HF 10:1 → 500:1

nitric/acetic/HF

2. The etchant of claim l, wherein said organic acid is selected from the group consisting of acetic acid, formic acid, and oxalic acid. 25:10:1

3. The etchant of claim 1, wherein said fluoride-containing solution is selected from the group consisting of hydrofluoric acid and ammonium fluoride.

4. The etchant of claim 1, wherein said organic acid comprises glacial acetic acid and said fluoride-containing solution comprises 49% hydrofluoric acid by weight in water.

5. (previously canceled)

6. The etchant of claim 4, wherein said acetic acid is in a volumetric ratio with said hydrofluoric acid at about 10:1 to about 100:1.

7. The etchant of claim 1, wherein said organic acid comprises glacial acetic acid and said fluoride-containing solution comprises 40% ammonium fluoride by weight in water.

8. The etchant of claim 1, wherein said etchant solution exhibits a selectivity ratio of borophosphosilicate glass to tetraethyl orthosilicate between about 27:1 and 55:1.

9. An etchant solution which selectively etches borophosphosilicate glass over tetraethyl orthosilicate, said etchant solution comprising an organic acid and a fluoride-containing solution, wherein the etchant solution exhibits a selectivity ratio of borophosphosilicate glass to tetraethyl orthosilicate between about 27:1 and 55:1.

10. The etchant of claim 9, wherein the organic acid is selected from the group consisting of acetic acid, formic acid, and oxalic acid.

11. The etchant of claim 9, wherein the fluoride-containing solution is selected from the group consisting of hydrofluoric acid and ammonium fluoride.

12. The etchant of claim 9, wherein the organic acid comprises glacial acetic acid and the fluoride-containing solution comprises 49% hydrofluoric acid by weight in water.

13. The etchant of claim 12, wherein the acetic acid is in a volumetric ratio with the hydrofluoric acid at about 1:1 to about 500:1.

14. The etchant of claim 12, wherein the acetic acid is in a volumetric ratio with the hydrofluoric acid at about 10:1 to about 100:1.

15. The etchant of claim 9, wherein the organic acid comprises glacial acetic acid and the fluoride-containing solution comprises 40% ammonium fluoride by weight in water.